

A MATHEMATICAL MODEL AND A METHOD
AND APPARATUS FOR UTILIZING THE MODEL

ABSTRACT OF THE DISCLOSURE

5 The present invention provides a model and a method and apparatus
for utilizing the model to simulate an imaging scenario. The model is mathematically
defined by analytical basis objects and/or polygonal basis objects. Preferably, the
10 model is a model of the human heart and thorax. Polygonal basis objects are only
used to define structures in the model that experience torsion, such as certain
structures in the heart that experience torsion during the cardiac cycle. The manner in
which the basis objects comprising the model are transformed by scaling, translation
and rotation is defined for each basis object. In the case where a basis object
15 experiences torsion, the rotation of the basis object will change as a function of the
length along the axis of the basis object about which rotation is occurring. During an
imaging system simulation, the model is utilized by a forward projection routine,
which integrates the linear attenuation coefficients associated with the rays emitted by
a simulated x-ray source and collected by a simulated detector array to obtain line
integrals corresponding to forward projection data. The forward projection data is
then processed to take into account the physics of the imaging technology, the x-ray
source and the detector array. The processed projection data is then processed and
back-projected by a reconstruction modeling routine to produce a reconstructed
representation of the model of the heart as a function of time.